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Technical Assistance in Support of Permitting Activities for the Thermal Destruction of PCBs

GCA Corp.
Bedford, MA

Prepared for

Industrial Environmental Research Lab.
Research Triangle Park, NC

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TECHNICAL ASSISTANCE IN SUPPORT OF PERMITTING ACTIVITIES FOR THE THERMAL DESTRUCTION OF PCBS

Prepared for

Office of Toxic Substances

Prepared by

Industrial Environmental Research
Laboratory
Research Triangle Park NC 27711

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The report describes phased efforts to identify, evaluate, and provide technical permitting assistance to utility boilers considering thermally destroying PCB-contaminated mineral oil. The project also required that State and Local Governments be provided information needed to aid permitting of a PCB verification burn.

KEYWORDS: *Incinerators, *Polychlorinated biphenyls, *Liquid waste disposal.

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ABSTRACT

The report describes phased efforts to identify, evaluate, and provide technical permitting assistance to utility boilers considering thermally destroying PCB-contaminated mineral oil. Identification initially concentrated on identifying ideal PCB destruction sites using size, age, location, and fuel use criteria to evaluate available boilers. This effort then extended to directly contacting U.S. EPA Regional Offices to identify utility boilers that had expressed an interest in the PCB disposal program. Regular bimonthly contacts were initiated with the Regional Offices and the status of all regional PCB activities was tracked. This contact produced three potential PCB burn sites operated by: (1) Consolidated Edison of New York, (2) Northeast Utilities, and (3) Pennsylvania Power and Light. Test plans were received from the first two and were reviewed and found acceptable: these facilities, however, subsequently withdrew their involvement with the PCB destruction verification burn program due to local community opposition. The Pennsylvania Power and Light Company site remains under active consideration. By the end of the technical performance period of this work assignment a candidate site has not been identified nor approved for testing. Appendices to this report detail the utility boiler site selection methodology, the status of PCB activities in EPA Regional Offices as of May 1, 1981 and the test plan evaluations for the Consolidated Edison and Northeast Utilities facilities.

The project also required that State and Local Governments be provided information needed to aid permitting of a PCB verification burn. Under this phase of the project a PCB "White paper" was prepared which summarized background technical information used in writing the PCB regulation (40 CFR 761). A second paper was prepared summarizing comments delivered at a public meeting entitled "What Should We Be Doing About PCB?" Both of these papers are provided as appendices to the report.

This report was submitted in fulfillment of Contract 68-02-3168, Work Assignment No. 12 by GCA/Technology Division under the sponsorship of the U.S. Environmental Protection Agency. This report covers the period of March 13, 1980 to April 15, 1981, and work was completed as of April 15, 1981.

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TECHNICAL ASSISTANCE IN SUPPORT OF PERMITTING ACTIVITIES FOR THE THERMAL DESTRUCTION OF PCBs

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DISCLAIMER

This Final Report was furnished to the U.S. Environmental Protection Agency by GCA Corporation, GCA/Technology Division, Bedford, Massachusetts 01730, in partial fulfillment of Contract No. 68-02-3168, Work Assignment No. 12. The opinions, findings, and conclusions expressed are those of the authors and not necessarily those of the Environmental Protection Agency or of cooperating agencies. Mention of company or product names is not to be considered as an endorsement by the Environmental Protection Agency.

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DOCUMENTATION OF CONTRACT EFFORTS

INTRODUCTION

In promulgating final rules for the disposal of polychlorinated biphenyls (PCBs) (40 CFR 761), the U.S. Environmental Protection Agency (EPA) recognized that high efficiency industrial and utility boilers could provide an environmentally safe alternative for burning dielectric fluids contaminated with from 50 to 500 parts per million (ppm) of PCBs. While select boilers did burn PCB contaminated oil prior to the adoption of the PCB rules, the operating and emission characteristics of these units were not rigorously documented. To insure that future PCB destruction efficiency "burns" will take full advantage of past PCB disposal experiences, to document the validity of the boiler equipment and performance requirements stated in EPA's final PCB rule, and to add to the public body of information in this area, EPA has sponsored comprehensive testing programs at a limited number of industrial and utility sites. Under this program, an oil-fired industrial boiler was tested at Bay City, Michigan in May 1980 and a coal-fired utility will be tested for PCB destruction efficiency in the summer of 1981 in Alabama. Efforts to locate and test an additional high efficiency utility boiler continue.

This Task Report will document salient work efforts conducted by GCA/Technology Division for the project "Documentation of PCB Destruction Efficiencies in a High Efficiency Boiler." This project had the following objectives:

- Identification and evaluation of PCB test burn candidate sites
- Provision of technical assistance to state and local government in considering permit applications
- Stack and ambient sampling, field and laboratory analysis, process monitoring, and data analysis and for of the candidate verification burn site(s) selected.

The sequential nature of these three phases required that a verification burn site be identified and assisted through the regulatory process before actual sampling could be conducted. Through the end of the technical performance period of this work assignment (April 1981) such a candidate site has not been identified nor approved for testing. Consequently, only tasks conducted and meeting the first two objectives are summarized here. This project report will detail GCA/Technology Division's efforts in this regard from 13 March 1980 through 1 April 1981.

IDENTIFICATION AND EVALUATION OF CANDIDATE SITES

GCA's initial actions in this program phase were directed toward identifying the number and location of utility boilers which met predetermined verification burn program criteria. Utility boilers were researched since all utilities are significant generators of PCB's and must dispose of PCB-contaminated waste oils in the 50-500 ppm concentration range. Faced with this disposal problem, it is anticipated that many utilities will take advantage of this program by utilizing their boilers for PCB waste oil disposal. In addition, as an industrial boiler has been successfully tested for PCB destruction efficiency (at Bay City, Michigan),[1] tests on a utility boiler would serve to complement this test series. Initially, potential utility candidate sites were to be selected on the basis of equipment criteria developed by GCA. These criteria were more restrictive than Federal Register requirements (40 CFR 761) in an attempt to find an ideal boiler whose PCB destruction efficiency results would be representative for the entire utility boiler population. For this initial boiler identification effort, the following criteria and rationale were used:

- 100 percent oil fired--since a coal-fired utility boiler (owned and operated by the Tennessee Valley Authority) has been previously identified for a test burn; testing of an oil-fired unit would serve to characterize additional segment of the boiler population; also oil firing would minimize potential fuel-related problems.

- Unit size--boilers with capacities in excess of 100 MW were desired as these larger units have more installed process flow measurement devices to thoroughly monitor operating conditions during a verification burn.

- Age--units less than 20 years old would tend to minimize corrosion and air leakage problems.

- Location--boilers outside metropolitan areas were to be selected in an attempt to minimize potential political and community opposition.

These criteria represented an "idealized" set of conditions that could be applied to the utility boiler population without physical onsite inspections. This enabled GCA to identify potential verification burn sites from existing published information. It was felt that boilers meeting the additional criteria would have fewer technical and political problems in obtaining regulatory approval and successfully destroying the PCBs. To identify these utility boilers, GCA obtained a computerized printout of all utility plants in the country with capacities in excess of 750 MW from the Energy Data System of the EPA Office of Air Quality Planning and Standards. Since boiler fuel was not listed on this printout, annual fuel consumption was obtained separately from a U.S. Department of Energy Report entitled "Cost and Quality of Fuels for Electric Utility Plants--1978," FPC Form No. 423. These two sources of information were combined and those facilities which met the size, age, and oil-firing criteria were extracted. This process resulted in a list of 14 boilers at eight utility plants. This limited number of boilers were considered restricting, therefore the 100 percent oil-fired criteria was

modified to include boilers which used fuel oil for at least 80 percent of their energy needs. This modification produced an additional nine boilers at five plants, for a total listing of 23 units at 13 separate sites. Appendix A describes this selection process together with the potential candidate boilers. This list was then sent to the Project Officer for dissemination to the EPA Regional Offices. These offices were asked to contact GCA should one of the "ideal" boiler sites notify the EPA of their intention to burn. It soon became evident, however, that none of the ideal sites was considering a PCB burn and that defining the ideal site would not in itself bring forth a cooperative utility, willing to voluntarily participate in the verification burn program.

The PCB regulations team of the Office of Pesticides and Toxic Substances (OPTS) included the candidate list in a survey questionnaire sent to each EPA Regional Toxic Substances Coordinator. This survey made Regional Coordinators aware of the GCA program, while soliciting information on all Regional PCB activities. It also served to introduce GCA to Regional personnel in preparation for further GCA contact. The Regional response to the OPTS survey was mixed, with some regional offices giving detailed summaries, while others did not respond at all. Overall, the survey did not adequately resolve the current status of PCB activities, nor did it identify a likely verification burn site. A copy of the survey questionnaire together with the introductory letter is included as Appendix B of this report.

The inadequate survey response, the continuing search for a verification burn site and the ongoing need to keep abreast of EPA Regional Office PCB activities led to the establishment of a bimonthly contact between GCA and Regional Office personnel. This contact was initiated in August 1980 and served to identify key Regional personnel involved with implementation of the PCB rules as well as to constantly update the status of industry interest with these regulations. While the nature of these contacts focused on utility boiler PCB burn applications, industrial sites with PCB disposal plans were also noted. A list of the EPA Regional contacts, PCB burn applications and the current (1 May 1981) status of Regional PCB activity is presented in Appendix C. The Appendix C listing also includes additional sources, found in the literature, which were known to have disposed of liquid PCB solutions in the past.

As Appendix C points out, PCB activity in certain EPA regions has been substantial while in others very little is being done. Regional staffing for PCBs also varies, reflecting these activity levels. Calendar year 1980 saw a substantial increase in routine inquiries from utilities concerning the PCB regulations and in the number of formal 30-day notifications given to regional offices in anticipation of a PCB test burn. Utilities which were known to have burned PCB waste oil in 1980 and 1981 included Middletown Station (Connecticut) of Northeast Utilities, Train Station (Maryland) of Baltimore Gas & Electric, Morgantown Station (Maryland) of Potomic Electric Power, Cities Services Company of San Antonio (Texas), San Bertron Station (Texas) of Houston Lighting and Power, Union Electric Company of St. Louis (Missouri), and Washington Water & Power of Spokane (Washington). Industrial activity in PCB disposal has similarly shown a marked increase in 1980-1981 with Region VI

receiving the largest number of industrial applications, including those for commercial hazardous waste incinerators at Deer Park, Texas and El Dorado, Arkansas. These two applications were subsequently approved.[2] Based on this recent interest in PCB disposal, it is expected that applications in this area will increase in the near future.

Contact between GCA, OPTS, and the EPA Regional Office personnel uncovered the first potential verification burn site in early 1980; the Ravenswood facility of Consolidated Edison (Con-Ed) Company of New York. With 50,000 gallons of PCB-contaminated oil stored onsite at this facility, Con-Ed proposed to burn this oil in accordance with the PCB Regulations (40 CFR 761)[3] while it conducted stack sampling to measure PCB emissions. The Ravenswood plant is located in the Astoria section of New York City and contains two identical oil-fired boilers each rated at 345 MW. The units were erected in 1962 and are of the tangentially-fired, balanced draft, twin furnace design. On first inspection both units met the pre-established "ideal criteria" for a verification burn site, except for their location in New York City. In addition, Con-Ed officials were willing to let the Ravenswood Plant be used for a verification test burn, provided all technical and administrative approvals could be obtained.

Con-Ed initiated action by making a formal submittal in early 1980 to the New York State Department of Environmental Conservation for permission to utilize the Ravenswood facility for a PCB burn. This submittal described the facility, its design and operating characteristics, and incuded a test protcol for a PCB sampling and analysis plan. The Region II Office of EPA was also sent a copy of this submittal, and was formally given a 30 day notification of Con-Ed's intent to burn PCBs, per Federal Register requirements (40 CFR 761).

EPA personnel forwarded GCA a copy of Con-Ed's submittal and asked GCA to evaluate the ability of the Ravenswood facility to achieve maximum PCB destruction efficiency. GCA's evaluation included an examination of the PCB feed system, the capacity of the facility to continuously monitor various combustion parameters and the condition of the boiler itself. In addition, relevant boiler data that would determine the feasibility of using this facility for a verification burn (compliance status, combustion efficiency, etc.) was reviewed. Finally, GCA was also asked to comment on the Con-Ed test protocol for sampling and analysis of PCBs at Ravenswood. This comprehensive analysis was the initial verification review of a potential candidate site conducted under this contract.

GCA's review of the Ravenswood facility began by comparison of the Con-Ed submitted with the PCB Regulations (40 CFR 761):

- Boiler is rated at a minimum of 50 million Btu per hour.
- If the boiler uses natural gas or oil, the carbon monoxide concentration of the stack is 50 ppm or less, and the excess oxygen is at least 3 percent when PCBs are being burned.
- The mineral oil dielectric fluid does not comprise more than 10 percent (on a volume basis) of the total fuel feed rate.

- The mineral oil dielectric fluid is not fed into the boiler unless the boiler is operating at its normal operating temperature (this prohibits feeding these fluids during either start-up or shut-down operations).

- The owner operator of the boiler monitors and records, at least once per hour, the carbon monoxide concentration and excess oxygen percentage in the stack gas while burning mineral oil dielectric fluid. If either measurement falls below the levels specified, the flow of mineral oil dielectric fluid to the boiler shall be immediately stopped.

- The primary fuel feed rates, mineral oil dielectric fluid feed rates, and total quantities of both primary fuel and mineral oil dielectric fluid fed to the boiler are measured and recorded at regular intervals of no longer than 15 minutes while burning mineral oil dielectric fluid.

Con-Ed's test plan satisfactorily addressed these criteria. GCA then addressed such additional items as:

- An operating schedule for the overall PCB burn,

- The layout of the PCB piping network and the ability to discontinue PCB feed without boiler disruption,

- Thermal efficiency of the boiler at different loads,

- The number, type and position of oil burners,

- The heat release rate(s), furnace temperature(s), and furnace volume(s), as they relate to fuel residence time(s),

- Materials of construction of all surfaces exposed to PCB contaminated oil and combustion products as they relate to potential chloride corrosion problems,

- The type and efficiency of any installed pollution control equipment,

- The proposed operating schedule of the boiler when burning PCBs, including the total quantity of PCB oil to be destroyed,

- Any anomalies about the boiler that would preclude the use of collected PCB destruction efficiency data for other utility boilers, and

- Existence of a spill prevention and control program.

In concert with this review was an evaluation of Con-Ed's test plan for sampling and analysis. This evaluation addressed additional items, incluing:

- Suitability of the proposed test method to collect and measure stack gas PCBs,
- Suitability of the proposed test method to collect and measure stack gas particulate emissions and PCB incomplete combustion products, including chlorinated dioxins and dibenzofurans,
- Quality control measures to be employed during laboratory analysis of samples,
- Acceptability of continuous flue gas monitoring equipment,
- Accessibility of sampling locations,
- The total sampling time required to collect 10 µg of PCB for laboratory analysis,
- Provision, if any, for workplace monitoring, including employee breathing zone tests and boiler operator blood testing, and
- Technique and sampling methodology for boiler residue sampling.

GCA's evaluation of the Con-Ed facility and test protocol was written up as a report and presented to the EPA Task Officer. A copy of this evaluation is presented as Appendix D.

Overall, the Ravenswood facility submittal was sufficiently detailed to be acceptable. Information that was not initially submitted, such as the total furnace volume was solicited directly from Con-Ed. The willingness of the utility to actively engage in a comprehensive test program was felt to be an important advantage in the use of Ravenswood for a verification test burn. However, there were several characteristics of the site that made it less than ideal. The boilers each contained two distinct furnaces, with a section of superheat tubes in between; a configuration not commonly found in the utility boiler population. PCB destruction efficiency data collected for these units may therefore not be readily extrapolated to other utility boilers of similar size. In addition, the flue gas flow is split into two separate streams after the second furnace, and exits to the atmosphere through two stacks for each boiler. This dual stack configuration would require twice the sampling effort and effectively double the sampling and analysis cost. Finally, the Ravenswood facility is located in a densely populated section of New York City, making it very sensitive to community opposition. This latter point proved to be the major obstacle to use of a Ravenswood boiler for a PCB verification burn. Con-Ed actively pursued their application with the New York State Department of Environmental Conservation and the EPA Region II Office throughout the summer and fall of 1980. After substantial interaction with these agencies and the public, they decided to withdraw the application in late fall of 1980, due to public concern over the potential affects of PCB emissions. This withdrawal ended GCA's involvement with this facility.

A second potential verification burn site was identified in June 1980; the Middletown, Connecticut facility of Northeast Utilities. Northeast Utilities gave a formal 30 day notification of its intent to burn PCB contaminated dielectric fluid to the EPA Region I Office on June 17, 1980. A copy of the submittal was also sent to the Connecticut Department of Environmental Protection (DEP). The proposed site was unit No. 3 at Middletown Station, an oil fired boiler rated at 233 Megawatts. GCA received a copy of the entire submittal on June 24, 1980 and initiated an evaluation.

The submittal by Northeast Utilities was detailed, comprehensive and addressed each PCB Regulations criteria in an orderly, systematic fashion. Most of the additional review criteria previously listed in this report for the Con-Ed submittal were also discussed. Specifically, the submittal included:

- A standard operating procedure for mineral oil burn period,
- A schematic of the mineral oil feed system,
- A dispersion modeling analysis indicating predicted worst case ground level PCB concentrations,
- An environmental evaluation of burning PCB mineral oil at Middletown Station, including the source and quantity of mineral oil, the disposal alternatives available, the transportation of the oil to Middletown Station and spill prevention measures.

GCA's evaluation of the Northeast Utilities submittal, including an estimate of the sampling time required to obtain a viable PCB stack sample, was sent to the EPA Task Officer. A copy of this evaluation is provided as Appendix E.

The reaction of EPA Region I personnel and Connecticut DEP personnel to the submittal was also favorable, and the submittal was approved by Region I on September 4, 1980.

Northeast Utilities was initially willing to participate in the voluntary verification burn program, barring any unforseen problems. Such a problem came to light before a test burn could be scheduled when the Town of Middletown obtained a court injunction barring any PCB burns at Middletown Station. The town's objections concerned potential public health problems of PCB emissions, and the lack of town involvement in the review and approval process. In an attempt to satisfy the town's objections, Northeast Utilities conducted several public hearings in the Middletown area, culminating in a public meeting held at Wesleyan University on 12 December 1980. A synopsis of this meeting will be subsequently discussed in this report. The court suit was resolved in favor of Northeast Utilities in February 1981. A trial burn was run at Middletown Station on February 10, 1981 to test all PCB delivery systems, with dielectric fluids containing 33 ppm of PCBs. A full scale burn, utilizing waste oil with PCB concentration in excess of 50 ppm, was originally scheduled for February 18, 1981 but not conducted. Due to the adverse publicity their proposed PCB burn had received, Northeast Utilities reversed

their earlier position and declined to participate in the verification burn program once the court suit had been resolved. They reserved the right to change their minds again at a later date.

A third potential verification burn site was identified in January 1981: Montour Station of Pennsylvania Power and Light Company (PP&L). The proposed boiler is a pulverized coal unit rated at 750 MW and equipped with electrostatic precipitators for particulate emission control. This utility had contacted EPA Region III and the Pennsylvania Department of Environmental Resources (DER) in January to informally inquire about the PCB program. PP&L was proceeding cautiously with their actual PCB burn application as they wanted to ascertain public opinion on this matter before making a full-fledged commitment. In this regard a public meeting was held by PP&L near the Montour facility site on 9 March 1981 with representatives of both EPA and Pennsylvania DER present. PP&L plans additional meetings in the future and has initiated a regular contact with a concerned citizens group in the Montour Station area. When informed by GCA of the verification burn program, PP&L expressed interest, but avoided full commitment at this time. GCA has subsequently visited PP&L offices to explain, in detail, the entire PCB program. Since PP&L remains interested, a regular contact between them and GCA has been initiated.

The first phase portion of this contract has therefore had mixed results. Positive accomplishments included the establishment of a bi-monthly contact with EPA Regional officials and the identification of key regional personnel responsible for monitoring and approving regional PCB activities. This contact was especially timely since utility interest in the PCB waste oil disposal program has increased significantly in the past 12 months. In addition, the history of PCB destruction in each region has been identified, to the best knowledge of the regional personnel. However, a verification burn site has yet to be found. Several potential facilities were identified and monitored for several months each before they eventually declined the use of their facilities.

The problem encountered by these facilities with political and community opposition to PCB burns raised significant questions as to the potential widespread use of utility boilers for PCB contamination dielectric fluid disposal. The need for a comprehensive public information program in this area was clearly demonstrated. Increased media attention to the generation and disposal of all hazardous wastes requires that the costs to society of all disposal options be clearly delineated so that the public can make rational choices. Utility officials indicated that continued widespread public opposition to the use of utility boilers for PCB waste oil disposal would force them to return to the previous practice of drumming this oil and shipping it to secure landfills located in some cases hundreds of miles away.

PROVIDE INFORMATION NEEDED BY STATE AND LOCAL GOVERNMENTS FOR PERMITTING OF A BURN

The second phase of GCA's contract involved providing information as needed by state and local governments for permitting of a burn. This effort

consisted of two distinct parts; assembling background information relative to PCBs in a report format and answering specific questions from EPA and state officials concerning technical aspects of a source application.

GCA prepared a "white paper" on the background technical information utilized in writing the current PCB regulations. This paper briefly summarized pertinent federal regulatory actions and the technical justifications and economic analysis performed prior to the promulgation of the regulations. Areas covered in the white paper included:

- major routes by which PCB's enter the environment
- federal regulations pertaining to PCBs
- a synopsis of PCB destruction efforts in high efficiency boilers and incinerators
- economic analyses for the final PCB rule
- current sampling and analysis techniques

The white paper is intended as an overview document on PCBs for Federal, State and local regulatory officials, although it can be also used to inform the general public of the rationale behind the PCB regulations. A copy of the white paper is included as Appendix F.

A second PCB informatinal package assembled by GCA was the minutes of a public meeting held in Middletown, Connecticut concerning a utility boiler PCB burn in that town. Entitled "What Should We Be Doing About PCB?"; the meeting was an open forum bringing together speakers on various aspects of the PCB disposal problems. The program presented included the following topics:

- The Industrial Use of PCB and Alternatives
- The Public Health Concerns Arising from Exposure to PCB
- The Regulation of PCB Disposal and the Environment
- Public Concerns Regarding PCB Disposal
- Regional Concerns in Handling PCB
- The Responsibilities of Municipalities in Relation to PCB Disposal

While the meeting was held relative to the specific proposal by Northeast Utilities to use their Middletown Station for a PCB waste oil burn, the issues discussed have widespread significance. The interrelationships of Federal, State and local governments, business, academia, environmental interests and the public health sectors of our society in addressing the hazardous waste disposal issue were brought out at this meeting. Given the intense political

debate that has arisen in this country over hazardous waste disposal, forums, such as that held in Middletown should prove to be a useful tool in stimulating a productive, open dialog among all concerned parties. The minutes of the Middletown meeting are presented in Appendix G.

Additional work conducted included answering questions from Federal and State environmental personnel on specific PCB-related topics. In this regard, questions pertaining to the temperature-time relationship of the Con-Edison Ravenswood boiler and the status of three specific PCB burn sites were immeditely answered. This technical assistance effort was typified by specific questions and short response time. It was provided on an "as-needed" basis.

Overall, work efforts conducted under this contract provided the framework for future activities in this area. The interest expressed by utilities and industry in thermally destroying their low (500 ppm) concentration PCB waste has risen dramatically since this contract was begun. A format for monitoring and reporting this interest has been developed. Select background information that can be used by regulatory officials at all levels of government has been assembled. While a utility boiler PCB verification burn site has yet to be conclusively identified and tested, the framework for identifying potential candidate sites has been established and will hopefully result in the conduct of a fully documented PCB destruction efficiency test in the near future.

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1. Hall, J., F. Record, P. Wolf, G. Hunt, and S. Zelenski, Evaluation of PCB Destruction Efficiency in an INdustrial Boiler. EPA-600/2-81-055a. Office of Research and Development, U.S. Environmental Protection Agency, Washington, D.C. April 1981.

2. EPA Region VI Approvals of Annex I Incinerators: Rollins Environmental Services in Deer Park, Texas, January 23, 1981; and Engineering Systems Company (ENSCO) in Eldorado, Arkansas, January 28, 1981.

3. 40 CFR 761 "Polychlorinated Biphenyls (PCBs), Manufacturing, Processing, Distribution in Commerce and Use Prohibitions." Federal Register, Vol. 44, No. 106, Thursday, May 31, 1979. pp. 31514-31568.

APPENDIX A

PCB DESTRUCTION IN UTILITY BOILERS

SITE SELECTION FOR A VERIFICATION BURN

INTRODUCTION

The disposal of PCB-laden waste transformer oil represents a significant waste disposal problem for electric utilities. Land disposal is effectively prohibited by government regulations and high temperature incineration systems for general use have yet to receive EPA approval. One disposal method currently available is the use of utility boilers to thermally oxidize the PCB's in the transformer oil. Under the overall EPA utility PCB-test program, a list of candidate units will be established, the operators of the units contacted, permission for use of their facility obtained, and a test burn conducted. During this test burn, the PCB-laden oil would be metered into the boiler fuel while a simultaneous stack emission test is conducted to ascertain the presence of PCB's in the exhaust gas stream. The goal of the program is to establish the ability of utility boilers to destroy the PCB's. This report will detail GCA's efforts in establishing the list of boilers that will be candidates for this test burn program.

BOILER CRITERIA

A list of likely boiler candidates must be based on a set of predetermined criteria. For this program, the units tested had to be "representative" so that the test results could be considered to have widespread application. A set of criteria defining this "representative" unit was established by GCA. These criteria include:

> Oil Firing - As PCB oil is to be metered in predetermined rates into the boiler fuel, the selection of only oil-fired boilers was considered important. Use of these units facilitates the metering of PCB oil without concern to how the fuel is atomized and dispersed in the boiler furnace. These units also minimize potential fuel related problems such as the effects of varying fuel quality and the possible adsorption of PCB's onto coal ash.
>
> Unit Size - GCA selected only those boilers with a capacity in excess of 100 Megawatts (MW). These larger units typically have more complete control systems and will allow the burning of a wider range of PCB feed rates, thus providing for test condition flexibility.

Age - Units installed since 1960 were selected. These newer units will be less likely to have maintenance problems (i.e., air leakage), have more sophisticated combustion controls and generally have better thermal efficiencies than older (pre-1960) units.

Location - Units located outside metropolitan areas were preferred to minimize population exposure to any PCB emission should problems occur during the test burn.

These criteria were established by GCA to minimize equipment and fuel variables in a test burn. They are not intended to reflect on the ability of any specific utility boiler to successfully burn PCB-laden oil. In fact, recent published data suggests that coal-fired units may be better units to use for long-term PCB thermal destruction due to the ability of their boiler tubes to withstand higher flue gas chloride concentrations. These criteria are subjective and can be altered should candidate units not be available nor interested in participating in this test program.

SELECTION METHODOLOGY

GCA began its candidate selection process with a list of all utility plants having capacities in excess of 750 MW. This computerized printout was obtained by accessing the Energy Data System (EDS) of the EPA Office of Air Quality Planning and Standards and is attached as Appendix A. The printout listed name and location of power plant and individual boiler number, size (MW), and year of start-up. Boiler fuel use was not specified. This data was obtained separately from a U.S. Department of Energy, Energy Data Report entitled "Cost and Quality of Fuels for Electric Utility Plants - 1978", FPC Form No. 423. This report provided the type, quality, and quantity of fuel used at each plant listed on the EDS printout. These two sources of information were combined and those facilities which met the size, age, and oil-firing criteria were extracted. This "first-cut" list of 24 boilers at 13 plants is presented in Table 1. However, 10 of these boilers at five plants were known to be located in urban settings and were therefore eliminated.

A "second-cut" was then made in the data in order to ensure the candidate list contained from 20 to 25 boilers. Rather than adjust size, age, or location criteria, GCA felt that units utilizing oil for a minimum of 80 percent of their energy requirements could also be potential test-burn candidates. These units typically use natural gas when it is readily available (in the summer), but burn oil the remainder of the year. While these units could not be tested while on natural gas, they would be acceptable for the majority of the year. The DOE report was again checked and an additional nine boilers at five plants added to the candidate list. The proposed list therefore constitutes 23 boilers at 13 utility plants, as is shown on the enclosed table.

FUTURE REFINEMENTS

In order to maintain a viable list of 20 to 25 candidate boilers, the criteria must be kept at a minimum. One additional factor, however, that will vary among those units already on our proposed list is the type of air pollution control device installed on each unit. This information was not readily available from published reports. The EDS must be accessed to obtain this control device data. Once the data are obtained, a decision must be reached on how to apply them, i.e., should one unit with each device be tested?, should only those units with electrostatic precipitators (the most efficient control), or no control at all be tested? While the control device type is not expected to affect the ability of the boiler to successfully destroy PCBs, the question of how this variance between units will affect their "representativeness" and therefore, the usefulness and applicability of their test results must be addressed.

Additional criteria such as stack test data and the number and type of oil burners were not included at this time to ensure the candidate list is sufficiently large. These criteria may be applied at some later date, should a choice be required between several available test sites.

TABLE 1. Initial list of utility boilers which meet the following criteria for PCB destruction verification: 1) Unit on Oil-Firing Only, 2) Unit Installed since 1960 and, 3) Unit Size Greater than 100 MW.

Plant Name	Location	Boiler No.	Year Installed	Boiler MW Capacity
Arthur Kill (U)	New York, NY	30	1969	535
Astoria (U)	New York, NY	40	1961	387
		50	1961	387
Bowline	Orange/Rockland, NY	1	1972	621
		2	1974	621
Brayton Point	Massachusetts	4	1974	450
Edgemoore	Delaware	4	1966	150
		5	1973	409
Indian Point	Hudson Valley, NY	11	1962	275
		12	1962	275
Middletown	Connecticut	3	1964	239
Mystic (U)	Boston, Mass.	6	1961	138
		7	?	~650
New Boston (U)	Boston, Mass.	1	1965	380
		2	1967	380
Northport	Long Island, NY	1	1967	375
		2	1968	375
		3	1972	375
Possum Point	Virginia	4	1962	239
Ravenswood (U)	New York, NY	10	1963	400
		20	1963	400
		30	1965	1028
Roseton	Central Hudson, NY	1	1974	621
		2	1974	621

(U) = Located in Urban Areas.

TABLE 2. Additional utility boilers which burn oil greater than 80% of the time, but not 100% of the time.

Plant Name	Location	Boiler No.	Year Installed	Boiler MW Capacity
Ormond Beach	California	1	1971	806
		2	1973	806
Ritchie	Arkansas	1	1961	359
		2	1967	545
Sanford	Florida	4	1972	436
		5	1973	436
Wilson	Mississippi	1	1966	545
		2	1971	783
Yorktown	Virginia	3	1974	882

APPENDIX B

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF PESTICIDES AND TOXIC SUBSTANCES

MEMORANDUM

SUBJECT: Implementation of PCB Rules

FROM: J. William Gunter, PCB Regulations Team Leader

TO: Regional Toxic Substances Coordinators

The PCB Regulations Team has several ideas for improving communications on implementation of the PCB rule, especially with respect to information useful in evaluating potential disposal facilities. We would like to establish ourselves as the clearing house for such information generated in the Regions as well as in the various R&D arms of EPA. The attached survey is to determine the extent of implementation of the PCB rules throughout the country. Please feel free to add your suggestions and comments at the end of the survey form.

Utilizing contracts managed by Dave Sanchez at IERL, we have begun a series of verification burns to document the ability of boilers and incinerators to destroy PCBs. This has been done with an industrial high efficiency boiler at Bay City, Michigan. The results should be available in August. TVA is working with us to plan a similar test of a large coal-fired utility boiler in Alabama. We are looking for a suitable oil fired utility boiler to test. Attached is a summary of utility boilers which have been identified as potential PCB verification burn candidates in each Region. In addition, a questionnaire is enclosed to help identify other utilities or industries which you believe may be considering destruction of PCBs in boilers, incinerators or other devices.

IERL has distributed the draft "Guidelines For Evaluating Thermal Destruction Methods" to you for comment. We also want to distribute copies of all test burn information we have which will help you evaluate PCB disposal facilities.

In other PCB rule areas, we are preparing lists, by region, of firms which have applied for exemptions from the processing and distribution in commerce rule. These will be distributed to facilitate inspections. I am enclosing a list of the people on

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the PCB team and their areas of specialization so that you may call on us for help. Our survey includes a page for you to update our list of the key PCB people in your Region. We also solicit their comments and suggestions.

Please send your responses to Glenn Kuntz (TS-794) as soon as possible. Thank you for your help.

List of Addressees:

I	W Heffernan	617-223-0585	PAUL
II	R Larsen	212-264-1925	RALPH
III	C Sapp	215-597-4058	CHUCK
IV	R Jennings	404-881-3864	RALPH
V	K Bremer	312-353-2211	KARL
VI	L Thomas	214-767-2734	LARRY
VII	W Brandner	816-374-6538	WOLFGANG
VIII	D Gillam	303-837-3926	DEAN
IX	G Gavin	415-556-4606	GERRY
X	J Everts	206-442-5560	JIM
IERL	D Sanchez		

SUMMARY OF UTILITY PCB VERIFICATION BURNS

CANDIDATES BY EPA REGION

In establishing a list of candidate units for the test burn program, our contractor, GCA, conducted a preliminary survey based on the following criteria:

- Oil-fired.
- Boiler capacity greater than 100 MW.
- Boiler less than 20 years old
- Boiler not located in highly populated urban area.

Based on facility data provided by the Energy Data System (EDS) of the EPA Office of Air Quality Planning and fuel use data provided by the U.S. Department of Energy, Energy Data Report entitled "Cost and Quality of Fuels for Electric Utility Plants in 1978," a "first-cut" list of 14 boilers, utilizing oil exclusively, was obtained:

EPA Region	Plant Name	Location	Boiler No.	Year Installed	Capacity (MW)
I	Brayton Point	Massachusetts	4	1974	450
	Middleton	Connecticut	3	1964	239
II	Bowline	Orange/Rockland, NY	1	1972	621
			2	1974	621
	Indian Point	Hudson Valley, NY	11	1962	275
			12	1962	275
	Northport	Long Island, NY	1	1967	375
			2	1968	375
			3	1972	375
	Roseton	Central Hudson, NY	1	1974	621
			2	1974	621
	Edgemoore	Delaware	4	1966	150
			5	1973	409
	Possum Point	Virginia	4	1962	239

A "second cut" screening produced 9 additional boilers. These units utilized oil for a minimum of 80% of their energy requirements and could also be potential test candidates:

EPA Region	Plant Name	Location	Boiler No.	Year Installed	Capacity (MW)
III	Yorktown	Virginia	3	1974	882
IV	Sanford	Florida	4	1972	436
			5	1973	436
	Wilson	Mississippi	1	1966	545
			2	1971	783
VI	Ritchie	Arkansas	1	1961	359
			2	1967	545
IX	Ormond Beach	California	1	1971	806
			2	1973	806

The proposed listing therefore consists of a total of 23 boilers at 13 utility plants. Dr. Steve Zelenski, the PCB verification burn project manager at GCA Corporation, may be calling you to gather information about high efficiency boilers in your region.

HQ PCB TEAM AREAS OF RESPONSIBILITY

Bill Gunter - Team Leader FTS-755-0920

Pam Moore - Import/Export, Section 21 Petitions FTS-755-1188

Peg Velie - Food & Feed Regulations, Ham Radios, Weeping Transformers FTS-755-1188

*Tom Barber - Manufacturing Exemptions, PCB Analytical Methods, Containerization, Storage FTS-755-1188

Glenn Kuntz - Disposal, Processing & Distribution Exemptions FTS-755-0920

*Tom will be leaving in July and will be replaced by Jim Huemmer at the end of August.

APPENDIX C

EPA REGIONAL STATUS UPDATE--MAY 1, 1981

REGION I

Regional Toxic Coordinator:	Paul Heffernan (617) 223-0585 Air & Hazardous Mat'l. Div. Pesticides & Toxic Subst. Branch
Regional PCB Coordinator:	Steven Fradkoff (617) 223-2007 Enforcement Division Air Compliance Section
Regional PCB Contact for Enforcement:	Jim Okun (617) 223-2006 Enforcement Division
Additional Contacts for PCB Incineration:	Rich Cagavnero (617) 223-5610 Permits Branch Thomas Michel (617) 223-5610 Enforcement Division

Applicants for PCB-Burns:

Unit	Application Rec'd.	Application App'd.	Comments
Middletown Station, CT Northeast Utilities	6/19/80	9/4/80	Trial burn conducted 2/10/81. No future burns scheduled at this time.
Merrimac Station No. 1 N.H., Public Service Company of New Hampshire	2/6/80	3/3/80	Test burn has not been scheduled.
Salem Harbor Station, MA New England Power	10/14/80	---	EPA approval imminent; awaiting state action.

REGION I (continued)

M.I.T., Cambridge, MA	---	---	Informal inquiry made to EPA office; formal notification has not been received.
General Electric Pittsfield, MA	---	8/19/80	Rotary kiln incinerator; permission to burn material with 500 ppm PCB denied. Permission to burn dielectric fluid with 50 to 500 ppm of PCB's approved. No test burn conducted to date.

REGION II

Regional Toxic Coordinator:	Ralph Larsen (212) 264-1925 Management Division
Regional PCB Coordinator:	Patrick Harvey (212) 264-9895 Enforcement Division
Regional PCB Contact for Enforcement:	Cathy Masimino (212) 264-0545 Enforcement Division
Additional Contacts for PCB Incineration:	Ernie Regna George Pavlov (212) 264-0504 Water Division Solid Waste Branch
	John Frisco Hazardous Waste Engineer (212) 264-4668

Applicants for PCB-Burns:

Unit	Application Rec'd.	App'd.	Comments
Ravenswood, Con-Edison, NY	1-80	---	Utility withdrew application after substantial interaction with N.Y. DER and EPA Region II.
Atlantic Electric, NJ	---	---	Informally inquired about regulations in mid-1980. No formal application made.
Alcoa, Messina, NY	2-81	---	Submitted 30 day notice for one time PCB burn. No burn date scheduled.

REGION III

Regional Toxic Coordinator:

Chuck Sapp
(215) 597-4058
Air & Hazardous Material Division

Regional PCB Coordinator:

Bill Schremp
(215) 597-0982
Air & Hazardous Material Division
Hazardous Material Branch

Regional PCB Contact for Enforcement:

Ralph Siskind
(215) 594-8915
Attorney
Enforcement Division

Additional Contacts for PCB Incineration:

K. K. Wu
Engineer
(215) 597-4058

Ed Cohen
Engineer
(215) 597-7668

Applicants for PCB-Burns:

Unit	Application Rec'd.	Application App'd.	Comments
Continental Can Company, Hopewell, VA	---	---	EPA conducted emission testing on lime kiln and power boilers in 1976.
Train Station, Baltimore Gas & Electric	---	---	Burned PCBs for a short time in 1980--ceased burning due to State of Maryland order
Morgantown Station Potomic Electric Power	---	---	
Montour Station, Pennsylvania Power & Light	---	---	Informal inquiry made to State DER and EPA Region II 1/81. Public meeting held 3/9/81. Formal notification awaiting further public interaction.

REGION IV

Regional Toxic Coordinator:	Ralph Jennings (404) 881-3864 Air & Hazardous Material Division Pesticides & Toxic Substances Section
Regional PCB Coordinator:	Same as above
Regional PCB Contact for Enforcement:	Ms. Constance Allison (404) 881-3864 Pesticides & Toxic Substances Section
Additional Contacts for PCB Incineration:	John Herrman (404) 881-3016 Air & Hazardous Material Division Residusls Management Branch

Applicants for PCB-Burns:

Unit	Application Rec'd.	Application App'd.	Comments
Sanford Station, Florida Power & Light	---	---	Conducted test burn on 5/26/76 on oil fired boiler. Results indicated 99.99% destruction efficiency.
Tennessee Eastman Company	---	---	Test conducted on coal fired boiler on 11-6/7/8/9-79.
Widow's Creek Station, Tennessee Valley Authority	---	---	Test burn on coal fired boiler Scheduled 7/81.

REGION V

Regional Toxic Coordinator:	Karl Bremer (312) 353-2291 Air & Hazardous Material Division
Regional PCB Coordinator:	Dr. Sheldon Simon (312) 353-2291 Air & Hazardous Material Division
Regional PCB Contact for Enforcement:	Ken Fenner (312) 353-2113 Water & Hazardous Material Division Program Manager
Additional Contacts for PCB Incineration:	Y. J. Kim (312) 886-6140 Air & Hazardous Material Division Hazardous Waste Management Section

Applicants for PCB-Burns:

Unit	Application Rec'd.	Application App'd.	Comments
Peerless Cement Company Detroit, MI	---	---	Applied for PCB oil burn in cement kiln in 1980 then withdrew application. EPA sponsored destruction test in rotary kiln conducted in 1978.
General Motors Bay City, MI	---	---	Conducted PCB destruction efficiency test on oil fired boiler in May 1980. Results indicated D.E. >99.99%.
Baldwin Station Illinois Power Company	6/80	---	Application under review by Region V.

REGION VI

Regional Toxic Coordinator:

Larry Thomas
(214) 767-2734
Air & Hazardous Material Division

Regional PCB Coordinator:

Jim Sales
(214) 767-8941
Air & Hazardous Material Division
Solid Waste Branch

Regional PCB Contact for Enforcement:

Dave Olshewsky
(214) 767-3274
Technical Contact-Enforcement Div.

Kirk Smith
(214) 767-2760
Legal Contact--Enforcement Div.

Additional Contacts for PCB Incineration:

Phil Schwindt
(214) 767-2727
Surveillance & Analysis Division

Applicants for PCB-Burns:

Unit	Application Rec'd.	Application App'd.	Comments
El Paso Products	---	'79	125 gallons of oil burned on 10/11/79.
City Services San Antonio	---	---	Initial burn conducted 1/13/81.
Kaiser Aluminum, LA	---	---	Installing CO, O_2 monitors, no test burn scheduled.
Sam Bertron Station Houston Lighting & Power	---	---	Test burn held 12/9/80.
Ensco, El Dorado, AK Rollins, Deer Park, TX	---	---	Incinerators approved by EPA Region VI, 2/81.
Dow Chemical -LA Division, Plaquemine, LA	---	---	Industrial incinerator--trial burn scheduled 1/80.

REGION VI (continued)

-TX Division, Freeport, TX	---	---	Industrial incinerator--trial burn scheduled 5/80.
-Oyster Creek Division, Freeport, TX	---	---	Industrial incinerator--trial burn scheduled 9/80.
Vulcan Materials, Geismar, LA	---	---	Industrial incinerator--trial burn scheduled 1/81.
PPG Industries, Lake Charles, LA	---	---	Industrial incinerator--trial burn scheduled 3/81.
Diamond Shamrock, Deer Park, TX	---	---	Industrial incinerator--trial burn scheduled 4/81.

REGION VII

Regional Toxic Coordinator:

Wolfgang Brandner
(816) 374-6538
Air & Hazardous Material Division
Toxic & Pesticides Branch

Regional PCB Coordinator:

Marvin Frye
(816) 374-6538
Air & Hazardous Material Division
Toxic & Pesticides Branch

Regional PCB Contact for Enforcement:

Scott Pemberton
(816) 374-2186
Attorney
Enforcement Division

Additional Contacts for PCB Incineration:

Steve Bush
(816) 374-6534
Air & Hazardous Material Division
Hazardous Waste Material Branch

Applicants for PCB-Burns:

Unit	Application Rec'd.	Application App'd.	Comments
Lehigh Portland Cement Company, Mason City, IA	---	---	EPA sponsored destruction test in rotary kiln conducted in 1978
Union Electric, St. Louis	---	---	Trial burn held 2/81.
Alcoa, Davenport, IA	---	---	Trial burn scheduled 9/80.
Kansas City Power & Light	---	---	Informal inquiry made 2/81.
U.S. Gypsum	---	---	30 day notification given for a one time burn. Burn scheduled 4/81.
Columbus and Southern Ohio Edison	---	---	Informal inquiry made 5/80.

REGION VIII

Regional Toxic Coordinator:

Dean Gillam
(303) 837-3926
Air & Hazardous Material Division
Toxic Substances Branch

Regional PCB Coordinator:

Steve Farrow
(303) 837-3926
Air & Hazardous Material Division
Toxic Substances Branch

Regional PCB Contact for Enforcement:

Ford Blackwell
(303) 837-2361
Enforcement Division

Additional Contacts for PCB Incineration:

Martin Byrne
(303) 837-4261
Surveillance & Analysis Division

Applicants for PCB-Burns:

Unit	Application Rec'd.	Application App'd.	Comments
Rocky Flats Nuclear Weapons Plant, CO	---	---	Approved 2/81. No test burn scheduled.
Utah Power & Light	---	---	Informal inquiry made 2/81.

REGION IX

Regional Toxic Coordinator:	Gerry Gavin (415) 556-4606 Air & Hazardous Material Division Hazardous Material Branch
Regional PCB Coordinator:	See above
Regional PCB Contact for Enforcement:	Ray Seid (415) 556-3450 Enforcement Division Permits Branch
Additional Contacts for PCB Incineration:	Susan Jackson (415) 556-9868
	Jim Suhrer (415) 556-4606 Air & Hazardous Material Division Hazardous Material Branch

Applicants for PCB-Burns:

Unit	Application Rec'd.	Application App'd.	Comments
No known activity			

REGION X

Regional Toxic Coordinator:	Jim Everts (206) 442-5560 Air & Hazardous Material Division Toxic & Pesticides Section
Regional PCB Coordinator:	Roger Fuentes (206) 442-2850 Air & Hazardous Material Division Solid Waste Management Branch
Regional PCB Contact for Enforcement:	Dennis Stefani (206) 442-1369 Enforcement Division
Additional Contacts for PCB Incineration:	Chuck Rice (206) 399-5562

Applicants for PCB-Burns:

Unit	Application Rec'd.	Application App'd.	Comments
Washington Water & Power Spokane, WA	---	1/81	Notification given, initial test held 2/18/81.

APPENDIX D

EVALUATION OF A UTILITY BOILER FOR A PCB DESTRUCTION VERIFICATION BURN ASTORIA, NEW YORK

July 25, 1980

Prepared by:

S. G. Zelinski
J. M. Hall
R. G. McInnes

GCA CORPORATION
GCA/TECHNOLOGY DIVISION
Bedford, Massachusetts 01730

Contract No. 68-02-3168
Work Assignment No. 12

Project Officer: David C. Sanchez
Industrial Environmental Research Laboratory
Environmental Protection Agency
Research Triangle Park, NC 27711

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SECTION 1

INTRODUCTION

In promulgating final rules for the disposal of PCBs (40 CFR Part 761), the Environmental Protection Agency (EPA) recognized that power generation facilities could provide an environmentally safe alternative for burning PCB contaminated mineral oil. Provided certain boiler design and operating criteria were met, the EPA concluded that "disposing of PCB contaminated mineral oil containing 50 to 500 ppm PCB in high efficiency boilers does not present an unreasonable risk to human health or the environment."

Burning of PCB laden oil in a utility boiler involves metering this oil into the boiler fuel line in prescribed concentrations and allowing the PCB to be exposed to the elevated furnace temperatures. Complete destruction of the PCB is insured by monitoring flue gas conditions including oxygen and carbon monoxide concentrations and temperature. The initial PCB test "burn" at a facility may also involve the collection of residual PCB which exists in the effluent gas stream in order to determine the absolute PCB stack concentration and hence, the PCB destruction efficiency of the boiler.

Utility boilers which are candidates for PCB burns must be evaluated regarding the probability of achieving maximum PCB destruction efficiency as it relates to parameters of boiler performance. The criteria for any boiler evaluation must include an evaluation of the PCB feed system, the capacity to continuously monitor various combustion parameters and the conditions of the boiler itself. The availability of sufficient boiler design data to determine if these established criteria are being met is essential. This report details the required boiler design data and the extent to which the Consolidated Edison Company's Astoria Generating Station meets recommended facility and operating requirements of a utility boiler to be used in a PCB verification burn. Section 2 describes the boiler evaluation criteria used in the following evaluation of the Consolidated Edison Facility.

SECTION 2

CRITERIA FOR BOILER EVALUATION

A candidate boiler must, at a minimum, meet the following established criteria (44 FR 31545):

- Boiler is rated at a minimum of 50 million Btu per hour.
- If the boiler uses natural gas or oil, the carbon monoxide concentration of the stack is 50 ppm or less,and the excess oxygen is at least three percent when PCBs are being burned.
- The mineral oil dielectric fluid does not comprise more than 10 percent (on a volume basis) of the total fuel feed rate.
- The mineral oil dielectric fluid is not fed into the boiler unless the boiler is operating at its normal operating temperature (this prohibits feeding these fluids during either start-up or shut-down operations).
- The owner or operator of the boiler monitors and records at least once per hour the carbon monoxide concentration and excess oxygen percentage in the stack gas while burning mineral oil dielectric fluid. If either measurement falls below the levels specified, the flow of mineral oil dielectric fluid to the boiler shall be immediately stopped.
- The primary fuel feed rates, mineral oil dielectric fluid feed rates, and total quantities of both primary fuel and mineral oil dielectric fluid fed to the boiler are measured and recorded at regular intervals of no longer than 15 minutes while burning mineral oil dielectric fluid.

To insure these criteria will be met during the actual burn of PCB contaminated mineral oil, the candidate boiler should be checked for the following key items before the test is begun:

- The PCB feed system must provide accurate flow control and the ability to discontinue PCB feed without boiler disruption.
- Data must be available on the boiler regarding: heat input; age; steam temperature and pressure; thermal efficiency; the number, type and position of burners; heat release rate; construction materials of the furnace, boiler types, economizer, and air heater; and specifications of required fuel type.
- Similarly, data is required on the type and flow rate of the air heater; and on the type, construction material and design efficiency of air pollution control equipment.
- Ability for continuous monitoring of the following parameters is required: fuel, combustion air, and steam flow rates; flame, furnace exit, air heater inlet, and stack temperatures, furnace, economizer outlet, and stack oxygen concentration and stack carbon monoxide concentrations.

The above items should be considered relative to the type and amount of material to be burned and the duration of the proposed burn period.

SECTION 3

EVALUATION OF THE CONSOLIDATED EDISON FACILITY AND TEST PROTOCOL

SOURCE DESCRIPTION

The Consolidated Edison Company of New York, Astoria Generation Station is located in Astoria, New York. The Astoria 40 and 50 units are tangentially corner-fired, balanced-draft, twin-furnace steam generation units manufactured by Combustion Engineering. Erected in 1962, these units were originally constructed for coal operation but were designed to burn either coal, oil, or natural gas. These boilers currently operate exclusively on oil at sustained loads. Use of natural gas is limited to pilot ignition and low load operations. There are 16 burners per furnace in each of two furnaces (four burners per level, four levels per furnace). The heat input at maximum operating capacity is $3,600 \times 10^6$ Btu/hr. Design conditions for 2.4×10^6 lb/hr steam flow are 2,100 psig throttle pressure, 566°C main steam temperature, 538°C reheat temperature, and 247°C feedwater temperature.

Approximately one-half of the oil guns are in service during low to moderate load conditions. Fuel oil pressure is increased to each of the guns to meet moderate increases in load demand. Extra oil guns are activated during periods of high demand.

The boiler has a standard set of safety controls, including automatic shutdown in the event of: flame failure, low fuel oil temperature, low fuel oil pressure, or excess steam pressure.

The PCB-contaminated mineral oil dielectric fluid is drained from the transformers and stored onsite in storage tanks and drums. Currently, 50,000 gallons of dielectric fluid are stored at the Astoria site.

FEASIBILITY EVALUATION

Design Considerations

- The unit should have a high thermal efficiency. Per the stack test unit efficiency is ∿87.5 percent which is excellent for an oil-fired unit originally designed for coal. The overall efficiency during the stack test as measured by

$$\frac{\text{Heat equivalent of electricity generated (Btu/hr)}}{\text{Heat input (Btu/hr)}}$$

  was 35.70 percent, which is good for generating units. However, Con Ed states that at the minimum load of 75 MW, the fuel feed rate would be 116 gpm. This translates to a thermal efficiency of 25.2 percent which is considerably lower than the efficiency at optimum load. This strongly suggests that the PCB burn should be conducted at higher load levels.

- A wall-fired unit with banks of fuel (coal) firing guns on opposite walls is often considered to be preferable to a corner-fired one (such as units 40 and 50) due to the "relatively lazy flame" of

these tangentially fired units. Substantial fuel/air turbulence is recommended to avoid channeling or bypassing of the PCBs. However, this need not, in itself, be a deterrent to use of the boilers for a PCB destruction verification burn.

- Unit 50 was designed for coal firing and therefore, its boiler tubes were probably constructed of chloride-resistent materials. Chlorides generated by PCB incineration should not present an operational problem with regards to boiler tube corrosion.

- This unit, with two furnaces, two stacks, etc., is somewhat of a rarity; data collected here may not be readily extrapolated to other utility boilers with regard to their ability to efficiently incinerate PCBs. In addition, without actual test data which demonstrates there is no difference between the stacks with regards to particulate and gaseous stratification and/or velocity profiles, at least one test would have to be run on both stacks simultaneously during a PCB burn. Homogeneous flow in both stacks cannot be implied by an examination of the stacks induced draft fans associated ductwork. This potential requirement for dual stack sampling could present problems related to equipment availability for sampling.

- No air pollution control equipment is currently in place on these boilers. This will permit evaluation of the destruction efficiency of the boiler without the intervention of a control device.

Suitability of Mineral Oil as a Boiler Fuel

It appears that mineral oil is very suitable as a boiler fuel based on the degree of miscibility with No. 6 fuel oil and their similarities in physical and combustion characteristics. The use of mineral oil and No. 6 fuel oil minimizes the concern for fuel atomization, fuel quality, and other fuel-related problems. However, before actual firing occurs, the mineral oil dielectric should be mixed and tested for physical compatibility with the particular batch of No. 6 fuel oil being used. Further chemical analyses of the mineral oil are probably not required.

Estimated Destruction Efficiency

The residence time of the PCBs in the furnace combustion zone is a consideration in the determination of the suitability of the site ofr PCB destruction. At a waste feed rate of 10 gpm, the actual volumetric flow rate of combustion gases through the 154,443 cubic foot furnace volume is 4.18×10^6 acfm, yielding a residence time of 2.2 seconds. The residence time and combustion zone temperature are adequate to ensure a high probability of achieving 99.9 percent PCB destruction with the low PCB concentrations to be utilized here. In addition, burner efficiencies and the ease of atomization of the mineral oil and the primary fuel oil are also in favor of good destruction at this boiler.

Dielectric Fluid Feed Rate and Boiler Load Changes

Con Edison intends to use a 10 gpm constant displacement pump to inject the PCB feed. At minimum load levels, this flow rate ensures that the 10 percent maximum feed rate is not exceeded. To ensure that the PCBs are fed and burned under relatively steady-state conditions independent of load variations, it is recommended that the boiler be operated under manual mode.

Onstream Instrumentation

Online monitors are available to measure CO and O_2 concentrations. These measurements will be continuously recorded during each sampling run. In addition, fuel, combustion air, and steam flow rates, air heater inlet, boiler, and exhaust stack temperatures, and other operating conditions of the boiler will be monitored.

SECTION 4

EVALUATION OF THE CONSOLIDATED EDISON TEST PROTOCOL SAMPLING AND ANALYSIS PLAN

SAMPLING CONSIDERATIONS

The overall test plan submitted by Consolidated Edison appears adequate for the pruposes stated in its Introduction. The test method cited in the Con Ed Test Protocol, is similar to the EPA method proposed by Mitchell (1976) in "A Preliminary Procedure for Measuring the PCB Emissions from Stationary Sources," U.S. Environmental Protection Agency, August 26, 1976, in the utilization of florisil as stack collection medium for PCB. The variations which were noted include a discrepancy between the test protocol impinger system and the EPA method, specifically whether impinger 2 is a tipless or plate impinger type. It is recommended that impinger 2 be of the plate impinger type to conform with the EPA method. Also, the use of a nylon hose to connect the probe-filter to the impingers is a questionable modification since the system should be all glass.

Instrumentation

Continuous monitoring for CO by Method 10 is suitable and the Beckman O_2 analyzer would be suitable for O_2 determination. A possible variation from the PCB regulation (44 FR 31519) is noted in that no provision for suspension of fuel feed is noted if the CO level exceeds regulation levels of 50 ppm. This provision must be added. In addition, it is recommended that the flame temperature in each furnace be measured and recorded.

Assessibility for Sampling

The sampling locations cannot be placed at the required distance downstream from the stream disturbance because of physical constraints. To compensate for this, the test plan includes the maximum number of sampling points. This problem was noted in the Boiler Emission Test Report and is unavoidable. The absence of cyclonic flow (null = 1^{o}) would indicate this location is acceptable for sampling.

Load Considerations

The sampling program for PCB testing does not specify the load requirements for the test burn. The test plan specifies and operating range between 75 to 345 MW. The choice of operating range will affect the sampling time and will also establish the load limit for any future PCB burns. All three tests should be conducted at the same and near maximum load in order to establish the burn load limits.

Sample Recovery

Sample recovery as noted in the test plan is reasonable except that the recovery procedure requires 30 ml each of the acetone and hexane for each rinse. The method proposed by Mitchell requires 100 ml each of acetone and hexane. The efficiency of removal for a 30 ml rinse is questionable and maintaining the 100 ml rinse is recommended.

Sampling Time

The sampling time necessary to yield 10 µg PCB for analysis given a detection limit in the stack gas of 1 ug/m is 548 minutes as demonstrated in the following calculation:

Boiler Conditions

Load: 337 MW

Fuel Feed: 22,210 gallons per hour

PCB Concentration in mineral oil: 300 ppm

Maximum mineral oil concentration: 10 percent

Flue Gas Flow Rate: 3,851,903 lb/hr

Stack Temp: $254^{\circ}F$ ($714^{\circ}R$)

Stack Pressure: +0.08 in. Hg.

PCB In

$$(22{,}210 \text{ gal/hr})\left(\frac{3.785 \text{ l}}{\text{gal}}\right)\left(\frac{300 \text{ mg}}{\text{l}}\right)(0.10) = 2.52 \times 10^{6} \text{ mg/hr PCB}$$

PCB Out

At 99.9 percent destruction efficiency (DE) = 2.52×10^{3} mg/hr

At 99.9 percent destruction efficiency (DE) = 2.52×10^{2} mg/hr

Stack Flow

ρ (gas density) std. cond. = 0.07495 lb/ft^3

correcting for stack conditions ($254^{\circ}F$ ($123^{\circ}C$) 30.00 in. Hg.)

$$= 0.07495 \times \left(\frac{460 + 70}{460 + 254}\right) \times \frac{30.00}{29.92} = 0.0558 \text{ lb/ft}^3$$

$$Q \text{ stack} = \frac{3{,}851{,}903 \text{ lb/hr}}{0.0558 \text{ lb/ft}^3} \qquad 6.90 \times 10^{7} \text{ ft}^3\text{/hr}$$

$$\text{At 99.9 percent DE, stack concentration} = \frac{2.52 \times 10^{3} \text{ mg PCB/hr}}{6.90 \times 10^{7} \text{ ft}^3\text{/hr}}$$

$$= 3.65 \times 10^{-5} \text{ mg/ft}^3$$

At 99.9 percent DE, to collect 1 µg PCB, we require

$$\frac{1.0 \times 10^{-3} \text{ mg}}{3.65 \times 10^{-5} \text{ mg/ft}^3} = 27.4 \text{ ft}^3$$

At a sampling rate of 0.5 ft^3/min, this requires 54.8 minutes.
To recover 10 µg of PCB at a DE of 99.9 percent, we must sample 548 minutes.

Conclusions and Recommendations

The Consolidated Edison sampling plan appears adequate for its stated purpose, which is the measurement of PCB destruction efficiency. However, the plan does not provide additional baseline data for future correlation between PCB destruction efficiency and emission levels or operating parameters of boiler performance. Neither does the plan estimate the environmental impact from PCB combustion. In order to provide baseline data and environmental impact estimates, we recommend the following:

- addition of simultaneous Method 5 particulate sampling trains to supply information on the effect of PCB waste combustion on boiler organic emissions, including chlorinated dioxins and dibenzofurans as well as polynuclear aromatic hydrocarbons (PAH),
- addition of 1 day of pretesting to the schedule during which background data on boiler emission could be generated,
- addition of an environmental analysis assessment predicting the maximum ambient concentration possible under "worst-case" modeling conditions, and
- addition of an ambient monitoring network if the modeling and stack gas measurements suggest a potential ambient impact. The ambient monitoring would be designed to assess PCB background levels and potential population exposure.

ANALYSIS CONSIDERATIONS

Method of Analysis

The Consolidated Edison Company's Test Protocol utilizes a perchlorination procedure as the primary method of PCB quantitation in stack samples. The proposed scheme provides sufficient analytical sensitivity to measure as little as 1.0 µg of PCB per total stack gas sample. This detection limit would certainly be adequate for destruction efficiency determination.

Quality Control

Although the perchlorination analysis is a well-documented procedure, it is still necessary to verify its successful use in any particular laboratory by analyzing replicate blanks and spiked samples. There is no mention of any such quality control verification in the Test Protocol. Pretest quality control is especially important for perchlorination procedures because of the occurrence of "false positive" results. In light of the above discussion, it is recommended that Consolidated Edison amend the Test Protocol to include pretest documentation of analytical quality control. Specifically required are:

- pretest QC checks on resins, reagents, and solvents for field use,
- pretest QC checks on reagents/solvents for laboratory use,
- pretest verification of precision and accuracy of analytical methods at stated detection limits, and
- Addition of a duplicate analysis of the proposed GC/MS confirmation of PCB on at least one unperchlorinated extract.

Additional Analyses

To determine the effect of burning PCBs on the production of other potentially hazardous organics, an additional sampling train is recommended. The various stages of this train should be analyzed for:

- analysis of particulate filter, probe rinses, and resin extracts from Method 5 train with an XAD-2 resin cartridge for: chlorinated dibenzofurans, dioxins, and PAH by capillary GC/MS; total chromatographable organics by GC/FID and nonvolatile organics by gravimetry

SECTION 5

RECOMMENDATIONS FOR CHANGES TO PROVIDE A MORE SUITABLE SITE

OPERATING PROCEDURES

A detailed work plan describing the operating procedures, employee assignments, health protection, and PCB handling and containment procedures must be written and evaluated prior to the verification burn.

The operating procedures should include the organizational structure delineating the specific individuals who will be responsible for boiler operation, safety, boiler monitoring, sampling analysis, and workplace monitoring. In addition, day-to-day scheduling, instrumentation, security provisions, and emergency provisions for the burn must be provided.

WORKPLACE MONITORING

Employee breathing zone tests can be conducted during the verification burn to determine the extent of boiler operator exposure to PCB. The sampling and analytical techniques which will be used for the employee breathing zone tests should follow the recommendations of the NIOSH Manual of Analytical Methods, Method P and CAM-253 for PCBs in Air.

Samples of the residue from within the boiler should also be taken, if possible, and analyzed to determine the extent to which boilerhouse operators could be exposed during cleaning of the boiler.

PCB HANDLING AND DISPOSAL

Spill Prevention and Control

A spill prevention program should be established for the mineral oil, fuel, and other hazardous materials. Cleanup procedures and containment of accidental discharges should be provided.

Waste Handling and Disposal

A temporary dike must be set up around the transfer area, sized to retain up to 10 percent of storage capacity. This can be made up of sandbags and polyethylene sheet.

Transfer pumps, hoses, and power connections must be provided. The transfor pump should have an adequate gpm capacity to prevent any unnecessary holdup time for the tanker.

PCB-contaminated materials such as oil drippings, absorbents, rags, gloves, clothing, boiler residue, etc., should be collected and deposited in sealable 55-gallon containers. The containers will be identified as containing PCB and will be serialized and logged. Full containers will be sealed, checked, and transported directly to the secured PCB storage area to await proper disposal.

Employee Training

The work plan should be reviewed with each operator who will be directly involved with the verification burn.

ENVIRONMENTAL IMPACT

The following are optional items which may be useful in establishing the overall safety of the verification burn:

- provision of an environmental impact assessment predicting the potential maximum ambient concentrations under "worst-case" meteorological conditions, and

- addition of ambient monitoring network if the modeling and stack gas measurements suggest a potential ambient impact. The ambient monitoring would be designed to assess PCB background levels and potential population exposure.

SECTION 6

CONCLUSIONS

The Con Ed site at Astoria presents the following advantages and disadvantages for use in a trial PCB destruction burn:

- Advantages
  - Con Ed is willing and able to conduct the burn and has good sampling and analysis support facilities,
  - a sufficient amount of PCB-contaminated transformer oil is available for a burn, and
  - the procedures for evaluating a request for a permit in New York State prevent the evaluation period from exceeding 90 days once the Con Ed application is complete.
- Disadvantages
  - the site does not appear to be representative of many other utility boilers,
  - the site is located in a highly populated area, and
  - the configuration of the boilers and stacks may present a problem in accomplishing a cost-effective sampling and analysis program.

APPENDIX E

EVALUATION OF PCB/UTILITY BOILER INCINERATION: NORTHEAST UTILITIES AUGUST 1980

Prepared by:

R. G. McInnes
S. G. Zelinski

GCA CORPORATION
GCA/TECHNOLOGY DIVISION
Bedford, Massachusetts 01730

Contract No. 68-02-3168
Work Assignment No. 12

Project Officer: David C. Sanchez
Industrial Environmental Research Laboratory
Environmental Protection Agency
Research Triangle Park, NC 27711

PCB/UTILITY BOILER INCINERATION

Northeast Utilities submittal to GCA per letter of 7/24/80 - Middletown Station, Unit 3.

COMMENTS ON SUBMITTAL:

Boiler Criteria (44 FR 31545)

- Blr >50MM BTU/HR?

  -Yes, Unit 3 rated at $2.^{185} \times 10^{9}$ BTU/HR (235MW)

- Blr CO Emission <50PPM and O_2 >3%

  - Yes, Unit tested on April 22, 1980 at 233MW (full load), 205MW (87% load), and 180MW (77% load). All tests indicated zero (0) percent CO, and O_2 ranging from 3.0% (at 233MW) to 3.6% (at 180MW).

- Mineral oil does not comprise more than 10 percent of total fuel feed.

  - At operating levels between 180MW and 233MW, Unit 3 consumes between 190 Gal/Min and 250 Gal/Min. The design mineral feed rate is 15 Gal/Min.

- The boiler must be at normal operating temperature before mineral oil may be fed to it.

  - Plant procedures specify that mineral oil will only be fed at boiler levels above 180MW; this assures normal operating temperature.

- CO and O_2 levels must be monitored at least once/hour and the boiler will be stopped if the readings fall outside specified ranges.

  - CO and O_2 will be measured continuously and recorded every half-hour. The instruments will be calibrated before and after the burn.

- Both primary fuel and mineral oil must be measured and recorded at least every 15 minutes during the burn.

  - This is included with the plant operating procedure for mineral oil burns.

ADDITIONAL ITEMS THAT ARE PROVIDED:

- Schematic of mineral oil feed system, including all valves and main fuel line hook-up.

- Standard operating procedure, including checklist for mineral oil burn periods.
- Make and model of both CO and O_2 instruments.
- Results of a dispersion modeling analysis which predicted worst case ground level concentrations of PCB and HCℓ assuming a destruction efficiency (DE) of 99.995%.
- Estimated destruction efficiency (DE) of 99.995% is based upon research data indicating this occurs at 1800°F and 1 second residence time. This unit has an average combustion zone temperature of 2300°F and the residence time is 1.5 seconds or greater.
- The plant expects to burn approximately 30,000 gallons per year of mineral oil (greater than 30,000 gallons required continuous stack CO and O_2 monitoring and they intend to continuously monitor).

ADDITIONAL INFORMATION THAT WILL AID EVALUATION:

- Design information on the boiler including steam temperature and pressure thermal efficiency, type, number, and position of oil burnes, construction materials for the furnace, economizer and air heater (if they have one), design fuel, type of air pollution control device and efficiency (if one is installed).
- Ability of the unit to continuously monitor combustion air and steam flow, furnace and stack temperature.
- Stack test location, accessability, any previous particulate stack test results.

GENERAL COMMENTS:

- Submittal is very detailed, covers all major points, includes a detailed operating procedure for the burning period and estimates worst case ground level concentrations.
- This site appears to be an excellent one with regards to conducting a simultaneous stack test by GCA, should the test location prove to be acceptable.

SAMPLING TIME:

The sampling time necessary to yield 10 μg PCB for analysis given a detection limit in the stack gas of 1 $\mu gm/m^3$ is 1290 minutes as demonstrated in the following calculation:

Boiler Condition-

Load: 235MW

Fuel Feed: 15,000 Gallons per hour

PCB Concentration with Mineral Oil: 200PPM

Maximum Mineral Oil Concentration: 6 percent (900 GPH)

Specific Gravity of Mineral Oil: 0.9

Flue Gas Flow Rate: $311.4 M^3/sec.$

Stack Temp: Unknown - Assume $310^{\circ}F$ ($770^{\circ}R$)

Stack Pressure Unknown: Assume 0

PCB In:

$$(15{,}000\ Gal/Hr)\left(\frac{3785\ell}{Gal}\right)(200\ mg/\ell)\ (0.9)\ (0.06) = 613{,}170\ mg/hr\ PCB.$$

PCB Out:

at 99.9 percent destruction efficiency = 613.17 mg/hr PCB.

Stack Flow:

(gas density) standard conditions = 0.07495 Cb/ft^3 correcting for stack conditions ($310^{\circ}F$) = $0.07495 \times \frac{(460 \times 70)}{(460 \times 310)} = 0.0516\ cb/ft^3$.

Q stack = $311.4\ m^3/sec$

= $10{,}989.3\ ft^3/sec$

= $39.562 \times 10^6\ ft^3/hr.$

At 99.995 percent DE, stack concentration:

$$\frac{613.17\ mg/hr\ PCB}{39.562 \times 10^6\ ft^3/hr}$$

= $15.49 \times 10^{-6}\ mg/ft^3$

To collect 1 µg PCB, we require:

15.49×10^{-6} mg/ft^3 .06456 x m^3 = 64.56 ft^3

At a sampling rate of 0.5 ft^3/min, this requires 129 minutes to recover 10 µg of PCB at a DE of 99.9 percent, we must sample 1290 minutes.

APPENDIX F

PCB WHITE PAPER

June 12, 1980

Prepared by:

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Contract No. 68-02-3168
Work Assignment No. 12

Project Officer: David C. Sanchez
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Research Triangle Park, NC 27711

EXECUTIVE SUMMARY

Widespread interest in the environmental significance of PCBs has led to intensive research into the hazards and distribution of these pollutants. Review of the conclusions from these investigations led to the promulgation of regulations controlling the manufacture, distribution, use, and disposal of PCBs. This document has been prepared in an effort to briefly summarize pertinent federal regulatory actions and the technical justifications and economic analysis performed prior to the promulgation of the regulations.

INTRODUCTION

The polychlorinated biphenyls (PCBs) are derivatives of the compound biphenyl in which from one to ten of the hydrogen atoms have been replaced with chlorine atoms. The PCBs which have been synthesized for commercial use are mixtures of isomers with different average chlorine contents. The chlorine content can range from 18 to 79 percent by weight.

One of the major producers of PCBs was Monsanto Corporation. Their materials were called Aroclors and were coded so that an Aroclor 1242 represented a PCB mixture that had a chlorine content of approximately 42 percent by weight.

The advantage of the PCBs lies in their excellent chemical and thermal stability. This led to their use in a variety of commercial applications, including dielectric fluids in capacitors and transformers, plasticizers, carbonless copying paper, hydraulic fluids and cutting oils. Such wide use and the lack of recognition of the potential hazard of the PCBs led to their being ubiquitously distributed in the environment.

The acute toxic effects of PCBs were brought to the forefront of public attention in 1968 after PCB-contaminated cooking oil caused widespread poisoning in Japan. Other incidents of PCB contamination within the U.S. brought attention to the methods employed for PCB disposal and the related dissemination into the environment. The release of PCBs into the environment was generally not controlled until the early 1970's. Up to 1977, approximately 1.25 billion pounds of PCBs had been purchased by industry in the United States. Of this amount, an estimated 60 percent is still in use; 4.4 percent has been destroyed by incineration or environmental degradation; and the remaining 35.6 percent (approximately 500 million pounds) is present in the environment. An estimated 65 percent of the PCBs in the environment is located in landfills or dumps. These reservoirs have temporarily immobilized the PCBs, but can potentially allow the release of the PCBs to add to the remaining 35 percent of PCBs that are free in the environment.

The following is a list of the major routes by which PCBs enter the environment:

- Landfill leaching from plastics and resins.
- Direct contamination into soils and rivers from leakage of heat transfer fluid or oils.
- Direct disposal of waste oils, waxes, and paints from industrial or other sources into rivers and other waterways.
- Recycling of PCB-containing paper and the release of washings into municipal sewage systems.

- Insecticide runoffs of PCBs which are used to extend the kill-life of aldrin, dieldrin and chlordane.

- Industrial smoke from the inadvertent incineration of PCB-containing materials as few facilities provide the required decomposition temperature and residence time.

As industry and government became increasingly aware of the hazards and environmental degradation associated with the use of PCBs, their sale was restricted and regulations appeared to control their manufacturing and disposal.

REGULATION OF PCBs

From July 1969 to August 1971, nine incidents of PCB contamination of food were reported. No record of human PCB poisoning in the U.S. has occurred, but near disasters have resulted in regulatory action. In 1973, the U.S. Food and Drug Administration (FDA) established temporary limitations of PCBs in food. A surveillance and inspection program by the FDA detected numerous lots of contaminated foods.

The Clean Water Act of 1977 contains the first regulation by the Environmental Protection Agency regarding PCBs. Under Section 307(a), manufacturers of electrical transformers and capacitors were prohibited from discharging PCBs into waterways (Federal Register, Vol. 42, February 2, 1977, pp. 6532-6556). These regulations stipulated February 2, 1978, as the deadline for compliance, allowing affected manufacturers 1 year to take the necessary steps (e.g., use of substitute materials and equipment or process changes) to eliminate PCBs from their effluents.

On March 26, 1976, as work was being performed on promulgating regulations for toxic effluents under the Clean Water Act, Senator Gaylord Nelson of Wisconsin introduced an amendment to the Toxic Substances Control Act (TSCA) for the phasing out of PCBs in manufacturing processes in the U.S. The TSCA was promulgated on October 11, 1976, and contained this amendment as Section 6(e). Section 6(e) requires the Environmental Protection Agency (EPA) to control the manufacture, processing, distribution in commerce, use, disposal and marking of PCBs.

The disposal and marking rule for PCBs, Section 6(e)(1), was promulgated by the EPA on Feburary 17, 1978, (Federal Register, Vol. 43, No. 34, pp. 7150-7164), and clarified in an addendum of August 2, 1978, (Federal Register, Vol. 43, No. 149, pp. 33918-33920). EPA published the proposed rules for Sections 6(e)(2) and 6(e)(3), which regulated PCB use, on June 7, 1978 (Federal Register, Vol. 43, pp. 24802-24817). These rules were supported by documentation, voluntary environmental impact statements and numerous public hearings. On November 1, 1978, EPA published interim rules for Section 6(e)(3)(B) establishing procedures for persons to petition the Administration of EPA for exemptions from prohibitions to manufacture, process, or distribute in commerce PCBs. The final rule, promulgated on

May 31, 1979, (Federal Register, Vol. 44, No. 106, pp. 31514-31568) declares the prohibition of processing, manufacturing, and distributing of PCBs after July 1, 1979, unless specifically exempted by EPA. The final rule became effective July 2, 1979.

TECHNICAL JUSTIFICATION FOR THE FINAL RULE

Destruction in High Efficiency Oil-Fired Boilers

Prior to the finalization of the PCB rule both theoretical calculations and field data were available which offered convincing evidence of the ability of an oil-fired boiler to destroy various concentrations of PCBs.

In October of 1976, Monsanto Research Corporation published a theoretical study on PCB emissions from stationary sources.[1] This report not only addressed the potential of formation of PCBs during the combustion of fossil fuels, but also the destruction of PCBs. The conclusion reached was that under thermodynamically controlled situations the "chlorinated biphenyls would react to essentially extinction."[1]

Prior to the publication of the Monsanto study, in May 1976, Florida Power and Light Company had reported on the results of a PCB burn conducted at their Sanford Unit No. 4. The stack sampling and analysis for PCBs was conducted by a private contractor. The results of this test in which PCB-contaminated oil was fired along with No. 6 fuel oil revealed no detectable amount of PCBs in the stack gas. The Method 5 particulate train was used for sampling, and Aroclor pattern matching by gas chromatograph-electron capture detection (GC-ECD) was used for analysis.[2]

In October of 1976 the EPA published a report detailing the emission testing at the Continental Can Company in Hopewell, Virginia, during PCB burning. This investigation reached the conclusion that the power boilers tested achieved greater than 99 percent destruction efficiency of the PCB present in the fuel.[3]

In December of 1977 the University of Dayton Research Institute under contract to the EPA published a report on the laboratory evaluation of high-temperature destruction of PCBs and related compounds. This evaluation established that PCBs could be destroyed at greater than 99.995 percent molecular destruction at a residence time of 1 second and a temperature of 1000°C.[4]

Destruction in Incineration Systems

Prior to the finalization of the PCB rule, incineration tests of high concentrations of PCBs had been conducted. In December 1976 the rotary kiln installation at Rollins Environmental Services, Inc. was tested for its ability to destroy PCBs.[5] The PCBs were introduced to the rotary kiln in the form of contaminated whole capacitors and contaminated hammermilled

capacitors. Calculated PCB destruction efficiencies for whole capacitors was 99.5 percent and for hammermilled capacitors, greater than 99.999 percent. The gas residence time in this system is of the order of 2 to 3 seconds with a flame temperature of about 1500°C.

In January 1976 PCB destruction tests were conducted at the St. Lawrence Cement Co.[6] The destruction efficiency of PCBs was calculated to be 99.986 percent. The kiln was maintained at 1450°C with an approximate residence time of 30 seconds.

In another test in 1976 at the Continental Can Company, PCBs in waste oil were fired into a rotary lime kiln maintained at 1260°C during the tests.[3] Destruction efficiency at this site was found to be 95.4 percent.

In a test in Sweden conducted by the Swedish Water and Air Pollution Research Institute a rotary cement kiln achieved a 99.9998 percent destruction efficiency of PCBs.[7]

These data for both high efficiency boilers and rotary-type kiln incinerators provided a convincing argument for the ability of these units to achieve high destruction efficiency of PCBs.

ECONOMIC ANALYSES FOR THE FINAL RULE

Prior to the promulgation of the final rule, economic analyses were conducted to assess the impact of the proposed rule. Versar, Inc. of Springfield, Virginia, prepared two documents for EPA: Microeconomic Impacts of the Proposed Marking and Disposal Regulations for PCBs (April 1977) and Microeconomic Impacts of the Proposed "PCB Ban Regulations" (May 1978). Versar revised these documents upon the request of EPA prior to the promulgation of the final rule. The final report is entitled PCB Manufacturing Processing, Distribution in Commerce, and Use Ban Regulation: Economic Impact Analysis, March 30, 1979.

Versar concluded that the proposed marking and disposal regulation would cost an estimated $62.2 million the first year. The cost would include new incinerators, new storage facilities, operating costs, chemical waste landfill charges, disposal transportation costs, recordkeeping for marking, and maintenance of storage facilities. The major economic impacts would apply to: utilities owning and using PCB-containing large high voltage capacitors; owners and users of high intensity discharge lighting capacitors, PCB small capacitors, or PCB large low voltage capacitors, or equipment containing such capacitors; manufacturers of equipment containing PCB articles; and manufacturers of large low voltage capacitors, small capacitors and fluorescent light ballasts.

The analysis of economic impacts for the PCB ban regulation was divided into transitional and long-term cost impacts. The transitional costs are those costs necessary to eliminate all existing PCB-containing equipment from service. For example, the total cost of the ban on sales of PCB capacitors

and equipment after July 1, 1979, including inspection and rework costs, could easily exceed $1 billion. The long-term costs will be continuing costs and will have a long-term economic impact. Examples include the increased cost of non-PCB transformers and power factor capacitors.

CONCLUSION

The intent of environmental legislative action is to protect the public health and welfare. This is accomplished by setting standards; establishing agencies capable of enforcing these standards; and actually implementing control mechanisms for the effective enforcement of pollution controls. Another function of statutory law is to establish conservation and development programs to enhance the quality of the environment. The promulgation of these regulations pursuant to Section 6(e) of TSCA exemplifies this intent.

The regulations as finally implemented serve as an excellent guide to the future use, storage and disposal of PCBs. However, the potential for exposure will remain until all PCBs have been adequately contained or destroyed as specified in the regulations.

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Federal Register, Vol. 45, No. 62, Friday, March 28, 1980, pp. 20473-20475.

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Environmental Research Brief, Thermal Degradation of PCBs. U.S. Environmental Protection Agency, Municipal Environmental Research Laboratory, Cincinnati, Ohio, October 1978.

Polychlorinated Biphenyls. National Academy of Science, Washington, D.C., 1979.

APPENDIX G

PUBLIC MEETING

FRIDAY, DECEMBER 12, 1980
Room 150, Science Center
Wesleyan University
Middletown, Connecticut

WHAT SHOULD WE BE DOING ABOUT PCB?

Morning Program

9:00 a.m. — Welcome:
Paul E. Waggoner, *Vice President*, Connecticut Academy of Science and Engineering

Moderator: Earl E. Hanson, *Chairman*, Science in Society Program, Wesleyan University

9:15 a.m. — *Topic:* The Industrial Use of PCB and Alternatives.
Robert C. Osthoff, General Electric Company, Schenectady, N.Y.

10:00 a.m. — *Topic:* The Public Health Concerns Arising from Exposure to PCB.
H. B. Matthews, National Institute of Environmental Health Sciences, Research Triangle Park, N. C.

10:45-11:00 a.m. — Coffee Break

11:00 a.m. — *Topic:* The Regulation of PCB Disposal and the Environment.
Glenn Kuntz, U. S. Environmental Protection Agency, Washington, D.C.

11:45 a.m. — *Topic:* Public Concerns Regarding PCB Disposal.
Wallace Pringle, Wesleyan University, Middletown, Conn.

12:30-1:30 p.m. — Lunch

Afternoon Program

Moderator: David M. Wetstone, *Secretary*, Connecticut Academy of Science and Engineering

1:30 p.m. — *Topic:* Regional Concerns in Handling PCB.
William C. Renfro, Northeast Utilities, Hartford, Conn.

2:15 p.m. — *Topic:* The Responsibilities of Municipalities in Relation to PCB Disposal.
The Honorable Michael Cubeta, Mayor, Middletown, Conn.

3:00-3:15 p.m. — Coffee Break

3:15 p.m. — Public Forum

Topic: Questions from the audience will be responded to by the speakers.

Cosponsored by the Connecticut Academy of Science and Engineering
and the Science in Society Program, Wesleyan University

GCA/TECHNOLOGY DIVISION

TO: Paul Fennelly DATE: 12 January 1981

FROM: Bob McInnes

SUBJECT: Public Meeting in Middletown, Connecticut - 12 December 1980
"What Should We Be Doing About PCB?"
PCB-Utility Boiler Program (1-619-012)

The following is a summary of each presentation at the subject meeting.

Robert C. Osthoff - G.E., Schenectady, New York

Topic: The Industrial Use of PCB and Alternatives

Industry has historically used PCB for fire safety considerations. Principal PCB uses: (EPA 560/6-76-005 gives quantities of PCBs used.)

- Investment Casting
- Plastics
- Capacitors (Fluorescent Light Ballast)
- Transformers
- Hydraulics & Lubricants
- Carbonless Carbon Paper

G.E. introduced a substitute dielectric fluid in 1975. The following items were criteria for this substitute.

- Fire Safety
- Insulation Valves
  - Breakdown
  - Impulse (Lighting, Accident)
- Resistivity
- Thermal Properties
- Chemical Compatibility
- Environmental Concerns
- Availability
- Factory Handling

G.E. chose a silicon based substitute which has the following properties.

- Low Vapor Pressure
- Lighter than Water
- Adsorbed on Solid
- Not Biodegradeable, but Degrades in Water by:
  - Hydrolysis
  - Thin Film Oxidation
  - Adsorption
- Ground Pollution Related Properties
  - Chemically Degradeable
  - Oxidizable
  - Ultraviolet Degradeable
  - Bonds Strongly to Silicon Materials

Dr. H. B. Matthews - N.I.E.H.S., Research Triangle Park, North Carolina

Topic: The Public Health Concerns Arising from Exposure to PCB

- N.I.E.H.S. has studied the metabolism, disposition, adsorption and excretion of toxic chemicals.
- PCBs are very complex mixtures, there are 210 possible PCB compounds.
- There are many halogenated hydrocarbons in addition to PCBs, including insecticides (DDT), herbicides, drugs, and cosmetics.
- Halogenation adds to hydrocarbons by imparting desirable properties such as increased resistance to decay, heat, etc.
- But halogenated hydrocarbons are not easily degradeable.
- PCB toxicology:
  - Dermatitis - chloro-acne (more intense, persistant).
  - Swelling of face, hands.
  - Stomach cramps.
  - Degeneration of liver (with high doses).
- Normal human tissue may contain 1 ppb of PCB
- First known PCB contamination was in Japan in 1968; symptoms included chloro-acne, more still births, slower growing babies and pain in the joints; estimated toxic dose in Japanese episode-2g over a few months.
- Aroclor, produced by Monsanto, is the American PCB
- American workers have been exposed to higher (than Japanese) PCB concentrations without effects
- Japanese PCB was "dirty", contaminated with dichlorofurans and other contaminants
- PCB in uses such as a heated environment may form additional contaminants

- Under lab conditions, the lethal dose for 50% of the population (LD_{50}) is 4,000 - 10,000 mg/KG. This is relatively high (e.g., malathion, a relatively safe insecticide has an LD_{50} of 300 mg/KG)
- Certain animals, including guinea pigs, monkeys, cattle, and mink are especially sensitive to PCB
- PCB is concentrated in mother's milk
- PCB is not mutagenic
- Carcinogenicity data for PCB is mixed
- Problem with PCB is its persistence in body tissue
- The major exposure route for the general unexposed population is ingestion through the mouth. Since PCB is not soluble in water, it must be metabolized in order to be excreted from body
- No known agent available to promote metabolism
- Mothers can pass unmetabolized PCB to young in milk, specifically milk fat
- PCB forms with 2 adjacent free carbon atoms are the most readily oxidized
- Some by-products of PCB oxidation can be extremely toxic, the LD_{50} for tetrachlorodibenzofuran, for example, is 1 mg/Kg - only dioxin is more toxic
- PCBs have affinity for adipose (fatty) tissue
- Dioxins, furans have affinity for the liver
- For any PCB, insecticide, etc., if the body cannot metabolize the compound, the substance will collect in the organ for which it has the greatest affinity
- Human health significance of long term, low dose exposure to PCB is unknown
- Sensitivity to PCBs varies among animal species
- No antidote for PCB toxicity is known, you can only treat symptoms

Summary: PCBs pose a threat if not handled correctly or due to leaks and accidents.

Glenn Kuntz - EPA-OPTS-PCB regulations Te[illegible], Washington, DC

Topic: The Regulation of PCB Disposal and the Environment

- Latest Developments - EPA has recently lost a court case to the Environmental Defense Fund (EDF)
  - 50 ppm Cutoff for PCB was Ruled Invalid
  - Definition of Transformers and Capacitors as Totally Enclosed Devices was Ruled Invalid
- Status of PCB Disposal Options
  - 2 Commercial Incinerators now Completed - ENSCO, El Dorado, Arkansas; Rollins, Texas; Test Burns conducted in late August, EPA awaiting Results.
  - 3 Additional Incinerators (in Tennessee, New York, and Massachusetts) have applied to Incinerate On-Site Generated Waste
  - Vulcanus - Incinerator Ship; recently sold to American firm; EPA hopes for a PCB Burn in Spring 1981; 2 years of active Incinerator Life left in Ship
  - High Efficiency Boilers, Bay City, Michigan - Test has demonstrated >99.99% destruction efficiency. There is 10 times more PCB contaminated mineral oil than high concentration PCB materials to be disposed of; several additional boilers under consideration for PCB burn, including Middletown, Connecticut, Potomic, DC, Baltimore Gas & Electric, Union Electric in St. Louis; in 1976 Sanford, Florida, conducted successful PCB Burn
- Chemical Means of Disposal
  - Sun Ohio Company of Canton, Ohio has a process that is carried on a truck; it was recently tested, preliminary results look good; EPA looking for a January, 1981, Approval
  - Goodyear Process; Goodyear will not demonstrate nor use this process and it is not Commercial
  - EPA working with the Food & Drug Administration, and the Department of Agriculture to ban PCBs in Food Feed and Fertilizer Applications; this action is on hold due to EDF Court Suit
  - All alternatives must address the same Liabilities and Limitations
    - Location
    - Facility Cost
    - Destruction Ability
    - Time Schedule
    - Transportation
    - Handling
  - Alternatives to PCB destruction in Northeast Utility (or any utility) Boiler

    A. Storage - 2,000,000 gallons of PCB laden oil now in storage throughout U.S., estimated cost for delays in adopting a disposal method if $34,000/6 months.

B. Chemical Waste Landfill - This option postpones the problem, there are 8 landfills in the country now approved for PCB disposal.

C. Chemical Destruction - What is applicability to large batch loads? SOHIO process only destructs low concentration PCBs now in use - it does not address stored PCBs. This process does have the advantages of being mobile, making location of PCB no problem, it gives good PCB destruction and does not result in air emissions.

D. Boilers - Local boiler such as Northeast Utilities offers the advantages of location, little transportation and handling, no new cost.

E. Incineration - Existing vs New vs Ship

- Existing - no new facility required; any PCB >500 ppm must be incinerated
- New - Costly, must be in highly populated, highly industrial area where waste is generated
- Ship - Staging Area Required; handling may be a problem; ship can destroy PCB, but there may be an outcry from cities used as staging areas. Also, since EPA does not allow PCB storage in flood plains, there are only a few coastal cities which meet this criteria. Finally, there is the question of ship availability

AUDIENCE QUESTIONS:

Q - How much PCB are left after use of the SOHIO process?

A - <10 ppm left.

Q - Is this O.K. with EDF court suit?

A - Maybe not, Disposal Rules have changed.

Q - What is the definition of a "successful burn"?

A - This depends upon the method used and is left to the Regional EPA Administrator to define. It should include a consideration of what is coming out, e.g., SOHIO process does consider outlet PCB concentration.

Q - EPA does not seem concerned?

A - It is not clear what levels of PCBs are a problem. The rule is set up to allow the Regional Administrator some flexibility.

Q - What about the toxic by-products of incineration?

A - There may be some since nothing is 100% oxidized.

Summary: There are two basic disposal methods, storage vs incineration; both have liabilities; the public must decide which they want.

Wallace Pringle - Wesleyan University, Middletown, Connecticut

Topic: Public Concerns Regarding PCB Disposal

- People must be interested, knowledgeable and informed. 1.2 billion pounds of PCB have been manufactured in last 50 years
- The List of Environmental Concerns Grows
  - Mercury in Swordfish
  - Kepones in St. James River
  - PCBs in Housatonic and Hudson Rivers
- PCB is a problem because it is indestructable. Unlike SO_2, it has no natural sources and sinks; it is not soluble in water and cannot be diluted by water. It has a low vapor pressure and will not become airborne unless emitted from smokestacks
- 51 people have died in Japan from PCBs
- Fatal dose in humans is approximately 2 g
- Allowable PCB limit in fish is 5 ppm; this was derived by using 2 g fatal dose, applying a safety factor of 10, and then using average human fish consumption
- Health affects of PCB are dealt with in length in a volume recently published by the New York Academy of Sciences
- Bioaccumulation of PCB is a real problem
- There has been no control in past PCB disposal
- How does the public participate?
  - Gather all known information on adverse effects
  - Add suspected effects; i.e., paradioxin in Agent Orange is the suspected toxic problem here
  - Consider Synergistic Effects - Σparts >total of individual elements
  - Public Health Considerations - Do we protect all citizens, including those with severe problems (e.g., emphysema) as is now the case, or do we set standards based on healthy citizens, thereby relaxing standards, as has been proposed
  - Public Welfare - Quality of Life - Do you care about dead fish? The snail darter? Eyes that tear?
  - Social - Economic Costs of Reducing Air Pollution - It is not practical and is extremely expensive to have no pollution - If you don't like the Regulation, what do you do?
- Specific PCB Regulation
  - We must get rid of them and not landfill them; an article in Environmental Science and Technology two months ago (Note V. 14, No. 5, 1980) concerned PCB and asked the question - How can you insure reproductibility in different boilers? - Sanford, Florida and Bay City, Michigan were no problem, but a test conducted in Hopewell, Virginia (on a boiler similar to that in Middletown) gave PCB destruction efficiencies of 99.2, 99.3, and 99.5%. Is 99.3% enough?

- What happens if you don't burn PCB completely? The incomplete combustion product is furan which is very toxic
- The regulation ought to be better defined; boiler efficiency cannot be completely defined by O_2 and CO measurements
- What is an acceptable risk for furans?

William Renfro - Northeast Utilities, Hartford, Connecticut

Topic: Regional Concerns in Handling PCB

- There are 35 million mineral oil transformers in New England. In addition, there are 5 million active capacitors with PCBs, ½ are owned by utilities. Finally, there are 140,000 PCB transformers. Northest Utilities (N.U) has 16,000 capacitors with 2-3 gallons of PCB oil in each, and ∿200,000 pole top transformers with 20-40 gallons of PCB mineral oil in each. Also there are many, large sub-station transformers
- In April, 1978, the first PCB regulations were issued and N.U. assembled a corporate team to address regulations
  - Capacitors with PCB >500 ppm were put into 55 gallon drums (per DOT Regulations) and transported to a special storage area to be finally buried in an approved landfill.
  - Mineral oil is awaiting final disposal options.
- July, 1979 - New PCB Regulations
  - Redefined cutoff concentration from 500 to 50 ppm of PCB by weight.
  - Previously any oil >500 ppm was sold to salvage.
  - With new regulations, there are 3 classes
    - PCB transformers with >500 ppm PCB
    - PCB transformers with <50 ppm PCB
    - PCB transformers with 50-500 ppm PCB
- N.U. expects to accumulate 30,000 gallons of PCB oil annually and foresees handling this quantity for the next 2-3 decades, due to long transformer life, although the quantities will decrease with time.
- N.U. sees 3 alternatives to disposal of this oil
  - Incinerate in an approved PCB incinerator
  - Burnal in a chemical waste landfill
  - Burn in a high efficiency boiler
- The disadvantages of each of these methods, as perceived by N.U. are
  - PCB incinerator - long distance transportation required; spills are a possibility; it uses incinerator capacity that is better used for other toxic substances, including high concentration PCB; no incinerators are yet approved; given the quantity of 50-500 ppm PCB oils generated throughout the country (18 million gal/yr) some 40-50 incinerators of the size and type operated by Rollins would be required.

- Landfills - long distance transportation required (N.U. currently transports its PCBs to Alabama); energy content of oil is wasted, potential risk to ground and surface water; good landfills are hard to come by. Conclusion: this is not a good long term solution for a nonbiodegradeable substance
- Boiler - N.U. has elected to use Middletown Station, Boiler #3 to burn its PCB laden oil. Comparing Unit #3 with the EPA criteria
  - Unit #3 is rated at 2000 x 10^6 Btu/hr (vs 50 x 10^6 Btu/hr required minimum)
  - No carbon monoxide (CO) has been measured in stack (vs 50 ppm of CO maximum permitted)
  - Oxygen (O_2) in stack is O.K. (minimum 3% O_2 required)
  - Fuel feed measured each 15 min., PCB oil is not >10% total oil feed (meets EPA requirements)
  - Boiler operated at full power, never 75% (meets EPA requirements)

- Advantages of N.U. Proposal Include
  - A number of automatic, fail-safe stops are incorporated on the boiler
  - Unit #3 is a cycling boiler with the hottest temperatures (∿2300°F) of any unit in the N.U. system
  - Residence Time (Tres) = 1.7 seconds
  - Plant Elevation >100 year flood plain
  - Unit #3 has high usage factor
  - Middletown plant is centrally located in system.

- Sequence of events in a PCB burn
  - Oil is transported in a 4000 gal. tanker truck to a dedicated 8,700 gal. storage tank; both have containment systems and spill control plans
  - Oil is pumped to 1 of 5 cyclone burners - all fail-safe systems will be tested during trial burn
  - Flame temperature ∿3000°F at burner - 80% of combustion takes place in cyclone burner before furnace
  - Tres burner = 0.2 seconds
    Tres furnace = 1.5 seconds
    At end of T = 1.7 seconds, Temp = 2000°F (at superheater tubes)
  - EPA figures state that for T = 1 second and Temp = 1800°F, PCB destruction efficiency = 99.995%; with greater time and temp. on Unit #3, the destruction efficiency should be greater

- To calculate ground level health effects, N.U. ran a dispersion model with known Unit #3 stack characteristics and assuming:
  - 500 ppm PCB oil
  - 99.995% PCB destruction efficiency
  - Average adult breathing rate = 22.8 liters per day
  - Maximum allowable body dose of PCB = 0.2 grams (= 2 grams known health effect ÷ safety factor of 10)

  Given these data, N.U. calculated that an individual standing at the point of maximum ground level concentration would need 1.5 billion years to inhale the 0.2 gr body dose

- Dioxins are not known to be formed (per TRW Report to EPA)
- Furans can be present as a contaminant in PCB - they should be quantitatively destroyed and N.U. concluded that they will not be emitted

Michael Cibelia, Mayor (Middletown, Connecticut)

Topic: The Responsibilities of Municipalities in Relation to PCB Disposal

- In mid-June, 1980, N.U. presented city with a copy of their proposal to EPA to dispose of 30,000 gal/yr of 50-500 ppm PCB oil
- Issues raised include - City of Middletown communication:
  - With N.U. - cordial, but less than thorough, e.g., N.U. stated there were no landfill sites for this oil, when there are in fact 3
  - With Connecticut Department of Environmental Protection (D.E.P.)
    - Stanley Pac, D.E.P. Commissioner endorsed proposal without contacting Town officials. (This lack of contact speaks for itself.)
    - With EPA - good - they delayed approval twice, but were often reduced to a defense of their own regulations
    - With public - keep them informed
- Existing EPA Regulations are faulty
  - They do not address time, temperature, turbulence in boiler
  - There are no ambient standards for PCB
  - 30 day consideration period is too short
  - Public hearing should be held
- At State Level
  - Proponent of waste site must demonstrate no adverse health effects will occur
  - D.E.P. permit should be required
  - D.E.P. should notify Town
- Towns do not have the technical expertise to review submittals, especially to evaluate bi-products of combustion